

# Nuclear Energy and Contamination



## STATEMENT OF THE PROBLEM

Nuclear power results from a process called nuclear fission. Nuclear fission is when an atom splits into two, which releases a large amount of energy. These split atoms continue splitting into other atoms creating a **chain reaction**, generating enough power to use as a reliable source of energy.<sup>1</sup>

As the amount of fossil fuels such as oil, coal and natural gas become **depleted**, nuclear energy provides an alternative energy source. In addition, fossil fuels emit **greenhouse gases**, for example carbon dioxide (CO<sub>2</sub>), which pollutes the atmosphere and leads to **global warming**. Nuclear energy is a much cleaner form of energy that does not release greenhouse gases into the atmosphere. Nevertheless, nuclear energy comes with its own set of risks, including nuclear contamination. The development of nuclear energy is very similar to the development of nuclear weapons, and can have similar explosive consequences.



## HISTORY OF THE PROBLEM

Nuclear energy was developed in the 1950s, following the efforts during World War II to build nuclear weapons. The first ever nuclear power plant opened on June 27, 1954 in Obninsk, Soviet Union. The plant generated electricity to homes and businesses for **civilian** use.<sup>2</sup>

The International Atomic Energy Agency (IAEA) was created in 1957 closely followed in response to the fears that nuclear technology could be used either as a weapon.<sup>3</sup> The three pillars of the IAEA are:

- safety and security, working to protect people and the environment from harmful radiation exposure;
- safeguards and verification, working to prevent the further spread of nuclear weapons, and;

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**Chain Reaction:** a series of reactions or events where the first event or reaction directly causes the second, and the second reaction or event causes directly causes the third, etc.

**Deplete:** to decrease or exhaust

**Greenhouse Gas:** gases such as carbon dioxide or methane that cause the greenhouse effect

**Global Warming:** an increase in the average temperature of the atmosphere that causes climate change

**Civilian:** a person who is not a member of the military or police

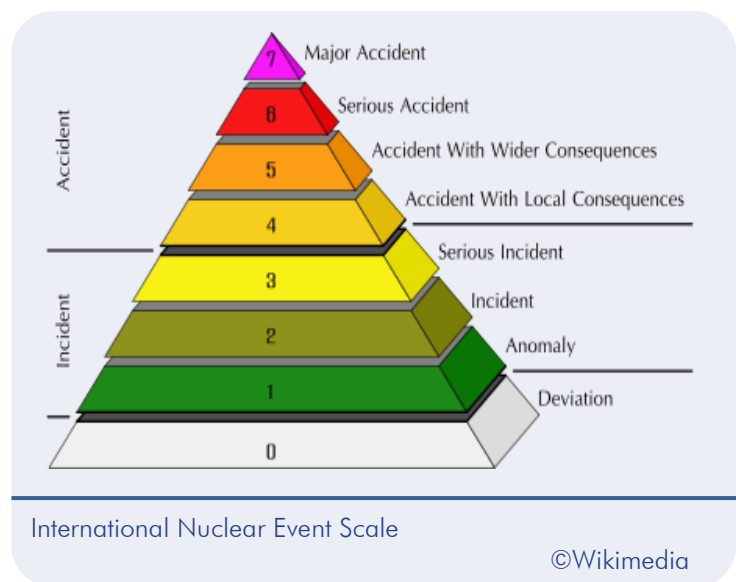


- science and technology, working to mobilize peaceful applications of nuclear science and technology to developing countries.<sup>4</sup>

The IAEA created a scale to measure nuclear catastrophes called the International Nuclear Event Scale (INES) in 1990. The purpose of this scale is to create unity between the technical community, the media, and the public to accurately raise awareness in cases of danger and keep the public informed.<sup>5</sup>

### Three Mile Island, United States 1979

The most serious nuclear accident in the United States happened at a nuclear power plant near Middletown, PA on March 28, 1979. Due to mechanical failures with the cooling system, the **core of the reactor** overheated to 4,300 degrees Fahrenheit. Overheating of the core reactor can cause the most dangerous kind of nuclear accident, when melted nuclear fuel can spread outside the boundaries of the power plant and release massive quantities of radiation into the environment. Luckily, however, the Three Mile Island accident did not produce this worst-case scenario, and there were no deaths to plant workers or members of the communities nearby. The lessons learned from this Level 5 accident led to improvements in emergency response planning in the form of fire protection and reliability of equipment. It also pressured the US Nuclear Regulatory Commission to heighten its oversight.<sup>7</sup> The events at Three Mile Island had a negative impact on US public perceptions on nuclear energy, which still affect public opinions in the 21<sup>st</sup> century.<sup>8</sup>



### Chernobyl, Ukraine 1986

The Chernobyl accident is considered to have been the worst nuclear power plant accident in history, classified as a Level 7 accident by the IAEA. It occurred on April 26, 1986 during a routine test when the plant's safety systems were turned off. The reactor powered down to 1% instead of 25%, which prompted the facility operators to manually raise the power levels. However, as the test began, the power surged unexpectedly leading to a full-scale nuclear meltdown. Unlike the accident at Three Mile Island, a violent explosion occurred and the core reactor melted and burned for a week as it reached temperatures of over 3,600 degrees Fahrenheit, leaking radiation into the environment. The results of the explosion were catastrophic. About 200,000 people had to be permanently relocated because high radiation exposure can lead to cancers such as leukemia or

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**Nuclear reactor core:** the portion of the plant containing the nuclear and radioactive fuel components



thyroid cancer. The IAEA reported 56 deaths that were directly linked to the accident, 47 plant workers and 9 children, but the report also stated that approximately 4,000-9,000 deaths could be related to the accident due to the long-term effects of radiation.<sup>9</sup> Radiation not only harmed the human population but also the wildlife in the Ukraine. Farmers lost their agricultural crops, which led to food shortages in affected areas and lost income for farmers in the area.<sup>10</sup>

## DISCUSSION OF THE PROBLEM

Nuclear energy remains a hot topic in world politics due to its risks, both in terms of nuclear disasters, and nuclear war and weapons development. However, the world suffers from an energy crisis as fossil fuels are running out and becoming more expensive. Mining factories need to drill deeper to reach fossil fuel resources, increasing the price of production, and causing further harm to the environment. The use of fossil fuels is also a main contributor to global warming. In addition, many nations have extracted most of its fossil fuel reserves, and have to rely on other countries, particularly in the Middle East, for their energy needs. This means that many countries do not have energy security. Renewable energy sources are the way of the future, and proper financing for projects and technologies in wind, solar, hydroelectric and biofuel power must be mastered. However, the technology for nuclear energy exists and is used now, and could be an option for the future energy needs of many countries. But, there are many risks to using nuclear energy.

### International Agreements

International agreements help regulate key issues in the world. The Treaty on the Non-Proliferation of Nuclear Weapons, also called the Nuclear Non-Proliferation Treaty (NPT), was ratified on March 5, 1970, and deals with the issue of nuclear technology.<sup>11</sup> The treaty guarantees the right of all states to develop nuclear technology for the purpose of nuclear energy as long as the country allows the IAEA to monitor their nuclear programs. The three main pillars of the NPT are:

1. non-proliferation, where non-nuclear-weapon states (NNWS) agree not to acquire nuclear weapons technology;
2. disarmament, where nuclear-weapon states (NWS) are urged to reduce and ultimately eliminate nuclear weapons, and;
3. peaceful uses, where states who have signed onto the treaty agree to develop nuclear energy for peaceful uses in coordination with the IAEA.<sup>12</sup>

Every country in the world have become signatories of the NPT except India, Pakistan, and Israel who have never signed the NPT, and North Korea who withdrew from the treaty in 2003. Although this treaty shows positive steps in regulating nuclear energy, many have argued that countries may exploit the NPT in order to hide nuclear weapon development programs. For example, while Iran claims to be constructing nuclear facilities for electricity, the United States and its allies suspect that it actually intends to produce nuclear weapons.<sup>13</sup> Similarly, North Korea has been accused of

building nuclear weapons. As a result, although an international agreement exists, nuclear energy still suffers from the risk of nuclear weaponry.

### Nuclear Energy: Pros vs. Cons

The table below describes the pros and cons of nuclear energy.

Pros	Cons
1. Does not emit greenhouse gases such as carbon dioxide into the atmosphere	1. Requires the mining of uranium
2. Generates more electricity than solar or wind power	2. Radioactive waste must be disposed of, but it is not <b>biodegradable</b> , so it must be stored, which is dangerous and can damage the environment
3. Create a market for jobs in developing nations working in nuclear energy plants	3. Public concerns over health, the environment and security of nuclear power plants
4. The likelihood of converting the uranium used in nuclear power plants into material for bombs is very low	4. The potential for the development of nuclear weapons, and the potential for terrorists to acquire nuclear material to build ' <b>dirty</b> ' bombs
5. Modern nuclear power plants are still safer than coal-burning plants	5. Accidents that occur have disastrous and long-lasting effects
6. Do not consume a lot of land, whereas solar and wind farms take up a lot of space	6. Use large amounts of water for their cooling systems, and can affect wildlife living in nearby waters
7. More reliable, generates electricity on demand <sup>14</sup>	7. Takes time to build nuclear power plants <sup>15</sup>

**Biodegradable:** the capability of a substance or an object to decompose

**Dirty Bombs:** a bomb that gives off a large amount of radiation when it explodes

## CASE STUDY: FUKUSHIMA, JAPAN 2011

The most recent example of a nuclear disaster is the Fukushima Dai-ichi incident. Following an earthquake and tsunami that hit Japan on March 11, 2011, the Fukushima plant lost power causing the cooling systems to fail and nuclear meltdowns to happen in three reactors. This disaster was classified by the IAEA as another Level 7 disaster, which makes it the worst nuclear accident since Chernobyl. 100,000 people were evacuated from the radiation-affected areas; however, no reported deaths were linked to the radiation. The damage was mostly contained as radiation drifted to the Pacific Ocean instead of inland, but the accident brought about new questions on the potential for radiation to cross borders and have **transnational** effects.

Deeper investigation into the Fukushima incident showed that the accident was ‘man-made’ meaning that greater precautions could have been taken to avoid such a catastrophe, indicating the failures to control nuclear energy and the risks of nuclear contamination. Before the events in Fukushima, Japan was a big supporter of nuclear energy and was the world’s third largest nuclear power consumer after France and the United States. However, the accident negatively altered Japanese public perception, and Japan has greatly reduced its nuclear energy capabilities, instead focusing future energy projects on renewable energy sources.

### Renewable Energy<sup>16</sup>

The Fukushima<sup>17</sup> Dai-ichi incident resulted in major backlash on nuclear energy; as a result, the future of energy seems to be in other renewable sources. The International Renewable Energy Agency (IRENA) was created on January 26, 2009 in Bonn, Germany, showing a growing commitment of countries to invest and develop renewable energy resources. So far, 104 countries have become signatories and 55 have applied for membership, totaling at 159 nations.<sup>18</sup> IRENA aims to help dialogue between nations wishing to pursue avenues in renewable energy, and encourage investment in renewable technology and innovations. It also tries to combine state level projects in an effort to create a global forum.<sup>19</sup>



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**Transnational:** going beyond the borders of one country; more than one nation involved

## PAST INTERNATIONAL ACTIONS

### Intergovernmental Panel on Climate Change (IPCC)

The international community's first step in addressing the threat of global warming was to create the *Intergovernmental Panel on Climate Change (IPCC)* in 1988. The IPCC has since produced four comprehensive reports on the state of the climate and its relationship to development. It is referenced by several UN bodies as they seek to address these issues.<sup>20</sup>

### The Kyoto Protocol (1997)

The Kyoto Protocol, part of the *United Nations Framework Convention on Climate Change*, recognizes that the earth system is a shared resource among all nations. It pressures developed nations to reduce their emissions, since they emit the largest percentage of greenhouse gasses. It also gives both developed and developing countries tools for increasing sustainable development around the world. The Kyoto Protocol has 190 signing nations and legally binding **targets** for emissions reduction during 2008-2012. Neither the United States nor Australia have signed the Protocol.

## QUESTIONS TO CONSIDER

This committee must come to a decision on whether or not to use nuclear energy.

- Does the use of nuclear energy have fewer negative effects than the use of fossil fuels?
- Do the pros of nuclear energy outweigh the cons?
- What are the risks of developing and using nuclear energy?
- What steps can be taken to make nuclear energy safer?
- Does your nation use nuclear energy?
- Does your country want to develop more nuclear energy in the future? Why or Why not?

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**Targets:** specific goals related to the amount of greenhouse gases a country will produce in a single year





## Citations and Photo Credits

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